AMENDMENTS TO THE SPECIFICATION

Please amend the Title of the Specification as follows:

DIGITAL IMAGE ~~PADDING METHOD, IMAGE PROCESSING APPARATUS, AND DATA RECORDING MEDIUM~~ <u>CODING/DECODING METHOD AND DATA RECORDING MEDIUM</u>

Please add the following paragraph to page 1 after the Title of the Invention:

<u>This is a Divisional Application of U.S. Application Serial No. 09/155,398, filed February 2, 1999, which is the National Stage of International Application No. PCT/JP98/00312, filed January 27, 1998.</u>

Please amend the paragraph beginning on line 15 of page 3 as follows:

By using the coding method for performing coding to the image signal for each object as described above, it becomes possible to combine objected freely to generate a composite image, whereby moving images can be reedited with ease. In addition, a moving image comprising only objects with high importance can be displayed without reproducing objects with relatively low importance, depending on <u>a</u> degree of congestion of a communication path, performance of a reproducing apparatus, or preference of a viewer.

Please amend the paragraph beginning on line 24 of page 3 as follows:

For coding an image signal of an object, (an image having an arbitrary shape), <u>a</u> waveform transform which performs signal processing adapting to a shape of the object, for example, shape adaptive DCT, or waveform transform to a padded image signal, is employed. In the method, specifically, padding is performed to an image signal forming an image space (rectangular region) by

replacing values of pixels in its insignificant region with padding pixel values obtained by a prescribed method, and then a conventional 8 X 8 cosine transform is performed to the padded image signal. The insignificant region is a region outside an object in the rectangular region, and comprises pixels which have no values for displaying the object. In other words, an image signal of the insignificant region comprises so-called insignificant sample values. Also, the 8 X 8 cosine transform is a waveform transform which performs cosine transform to the image signal of the rectangular region for each image space comprising 8 X 8 pixels.

Please amend the paragraph beginning on line 17 of page 4 as follows:

As a method for eliminating redundant ~~signal~~ signals between adjacent frames, there is a method for obtaining a difference between an image signal of a target macroblock to be coded and its prediction signal for each image space (macroblock) comprising 16 X 16 pixels, as a prediction error signal (difference signal). Here, it is assumed that the prediction signal is an image signal of ~~an~~ a prediction region obtained by motion compensation. The motion compensation process detects a region comprising 16 X 16 pixels corresponding to an image signal in a coded or decoded frame where a difference between the image signal of the target macroblock and the image signal is the smallest, as a prediction region.

Please amend the paragraph beginning on line 14 of page 5 as follows:

As a solution to this, padding is performed to the image signal of the prediction region by replacing insignificant sample values by prescribed padding values, and then a difference between the padded prediction signal and the image signal of the target macroblock is computed as a difference signal (prediction error signal), which is subjected to transformation for coding. This padding of the prediction signal can suppress the difference signal.

4

Please amend the paragraph beginning on line 13 of page 6 as follows:

In the interlaced image, especially in a case where motion of an object is large, there is low correlation of pixel values between adjacent scanning lines. Figure 18 schematically shows an example of an arrangement of pixel values which shows ~~thus~~ the low correlation of pixel values between adjacent scanning lines in the interlaced image, as arrangement of pixel values in an image space 301.

Please amend the paragraph beginning on line 11 of page 7 as follows:

Next, a prior art padding method and its ~~adding~~ padding result will be described with reference to Figures 18 and 19.

Please amend the paragraph beginning on line 19 of page 9 as follows:

Resampling which divides pixels forming the image space 380 into pixels corresponding to odd-numbered and even-numbered fields based on an assumption that the image space 380 is a frame, results in an image space 381 comprising plural pixels corresponding to the odd-numbered field and an image space 382 comprising plural pixels corresponding to the even-numbered field asa shown in figure 20. In the image spaces 381 and 382 corresponding to these respective fields, sample values of pixels are non-uniform, which introduces high-frequency components into image signals in image spaces 381 and 382.

Please amend the paragraph beginning on line 23 of page 10 as follows:

Further, ~~the~~ a similar problem occurs in padding methods other than the above, which computes padding values using significant sample values adjacent to insignificant pixels in the horizontal or vertical direction.

5

Please insert the title <u>Summary of the Invention</u> before the paragraph beginning on line 2 of page 11 and delete the title <u>Disclosure of the Invention</u> beginning on line 13 of page 11 of the specification.

Please amend the paragraph beginning on line 14 of page 11 as follows:

According to ~~claim~~ <u>a first aspect</u> of the present invention, a digital image padding method ~~of the present invention~~ <u>is provided</u> for performing padding of pixel values to a digital image signal forming an original image space comprising an image having an arbitrary shape and comprising significant pixels and insignificant pixels, comprises a pixel rearrangement step in which plural pixels in the original image space are grouped according to a prescribed rule, to form plural small image spaces each comprising pixels of the same group; and a pixel padding step in which values of insignificant pixels in each small image space are replaced with padding pixel values generated by a prescribed method.

Please amend the paragraph beginning on line 25 of page 12 as follows:

According to ~~claim 2~~ <u>a second aspect</u> of the present invention, in the digital image padding method of ~~claim 1~~ <u>the first aspect of the invention</u>, in the pixel rearrangement step, sampling is performed by extracting pixels every $(N + 1)$ -th $(N$: positive integer) pixel in a prescribed direction of the image space $(N + 1)$ times by using the first to the $(N + 1)$ -th pixels as starting sample pixels, to form $(N + 1)$ pieces of small image spaces each comprising a prescribed number of pixels obtained by one sampling.

Please amend the paragraph beginning on line 18 of page 13 as follows:

According to ~~claim 3~~ <u>a third aspect</u> of the present invention, in the digital image padding method of ~~claim 2~~ <u>the second aspect of the invention</u>, operation values obtained by performing operation on values of significant pixels in an N-th $(n=1, 2, ..., N + 1)$ small image space are used as the padding pixel values for replacing the values of insignificant pixels in the n-th small image space.

Please amend the paragraph beginning on line 6 of page 14 as follows:

According to ~~claim 4~~ a fourth aspect of the present invention, the digital image padding method of ~~claim 2~~ the second aspect of the invention further comprises an image space restoring step in which plural pixels forming padded small image spaces are rearranged following a rule adapted to the prescribed rule of the grouping so that these pixels forms a restored image space which has the same pixel rearrangement as the original image space.

Please amend the paragraph beginning on line 23 of page 14 as follows:

According to ~~claim 5~~ a fifth aspect of the present invention, in the digital image padding method of ~~claim 4~~ the fourth aspect of the invention, operation values obtained by performing operation on values of significant pixels in an n-th (n=1, 2, ..., N+1) small image space are used as the padding pixel values for replacing the values of insignificant pixels in the n-th small image space.

Please amend the paragraph beginning on line 11 of page 15 as follows:

According to ~~claim 6~~ a sixth aspect of the present invention, in the digital image padding method of ~~claim 1~~ the first aspect of the invention, in the pixel rearrangement step, sampling is continuously performed twice using the first and second pixel rows as starting sample pixel rows, by extracting pixels on every other pixel row in the vertical direction of the original image space, to form first and second small image spaces each comprising a prescribed number of pixels obtained by the first and second samplings, respectively.

Please amend the paragraph beginning on line 10 of page 16 as follows:

According to ~~claim 7~~ a seventh aspect of the present invention, a digital image padding method for performing padding of pixel values to a digital image signal forming an original image space comprising an image having an arbitrary shape and comprising significant pixels and insignificant pixels, comprises the steps of dividing the original image space into a first small image space comprising pixels on odd-numbered pixel rows in the original image space and a second small

image space comprising pixels on even-numbered pixel rows in the original image space; and generating first padding pixel values from values of significant pixels in the first small image space and replacing values of insignificant pixels in the first small image space with the first padding pixel values, and generating second padding pixel values from values of significant pixels in second small image space and replacing values of insignificant pixels in the second small image space with the second padding pixel values.

Please amend the paragraph beginning on line 18 of page 17 as follows:

According to ~~claim 8~~ an eighth aspect of the present invention, a digital image padding method for performing padding to a digital image signal forming an original image space comprising an image having an arbitrary shape and comprising significant pixels and insignificant pixels, by replacing values of insignificant pixels with padding pixel values determined from values of significant pixels in the original image space, wherein, significant pixels which have values used for determining the padding pixel values are pixels other than pixels adjacent to insignificant pixels to be padded.

Please amend the paragraph beginning on line 16 of page 18 as follows:

According to ~~claim 9~~ a ninth aspect of the present invention, in the digital image padding method of ~~claim 8~~ the eighth aspect of the invention, significant pixels which have values used for determining the padding pixel values are one pixel apart from the insignificant pixels to be padded.

Please amend the paragraph beginning on line 8 of page 19 as follows:

According to ~~claim 10~~ a tenth aspect of the present invention, an image processing apparatus for performing image coding which comprises a correlation identifying ~~means~~ device for identifying correlation between pixel values of a digital image signal and outputting a sample identifier according to the identification result, a coding section for performing differential coding to the digital image signal by the use of a prediction image signal of the digital image signal according to the sample identifier and outputting a coded image signal, and a predicting section for producing the prediction

8

image signal based on a decoded image signal in which the coded image signal has been locally decoded, the coding section comprises a subtracter for computing difference between the digital image signal and the prediction image signal as a difference signal; a data compressing ~~means~~ device for compressing the difference image signal to produce a compressed image signal; and a variable length encoder for performing variable length coding to the compressed difference signal, and the predicting section comprises a data expanding ~~means~~ device for expanding the compressed difference signal to produce an expanded difference signal; an adder for adding the expanded difference signal to the prediction image signal to produce a decoded image signal; a padding ~~means~~ device for performing padding according to the sample identifier by rearranging pixels in an image space formed by the decoded image signal and replacing values of insignificant pixels in the image space where the pixels have been rearranged with padding pixel values generated by a prescribed method; and a prediction image signal producing ~~means~~ device for producing the prediction image signal from the padded decoded image signal according to the sample identifier.

Please amend the paragraph beginning on line 15 of page 20 as follows:

In the digital processing apparatus thus constructed, the predicting section for producing the prediction image signal of the digital image signal, comprises the padding ~~means~~ device for performing padding of pixel values to the decoded image signal in which the coded difference signal has been locally decoded in its differential coding process, and is used for producing the prediction image signal from the padded decoded image signal, the padding ~~means~~ device first rearranging pixel values of the decoded image signal and then replacing the values of the insignificant pixels of the decoded image signal with the prescribed padding pixel values. Therefore, when performing differential coding to the digital image signal of the interlacing scanned image or the image of a stripe pattern having an arbitrary shape, it is possible in padding process to avoid introduction of high-frequency components into the prediction image signal for use by differential coding, differential coding can be performed to the interlacing scanned image while suppressing degradation of coding efficiency resulting from the padding.

Please amend the paragraph beginning on line 10 of page 21 as follows:

According to ~~claim 11~~ an eleventh aspect of the present invention, in the image processing apparatus of ~~claim 10~~ the tenth aspect of the invention, the coding section further comprises a padding ~~means~~ device for performing padding to the difference image signal according to the sample identifier by rearranging pixels in the image space formed by the difference image signal and replacing values of insignificant pixels in the image space where the pixels have been rearranged with padding pixel values generated by a prescribed method, and the data compressing ~~means~~ device performs information compression to the padded difference image signal to produce a compressed difference image signal.

Please amend the paragraph beginning on line 21 of page 21 as follows:

In the image processing apparatus thus constructed, pixel values of the difference image signal input to the data compressing ~~means~~ device are rearranged, and then padding is performed by replacing values of the insignificant pixels of the difference signal with the prescribed padding pixel values. Therefore, it is possible to avoid introduction of high-frequency components into the image signal input to the data compressing means. As a result, when performing differential coding to the digital image signal of the interlacing scanned image or the image of a stripe pattern having an arbitrary shape, waveform transform such as DCT is performed with high efficiency.

Please amend the paragraph beginning on line 8 of page 22 as follows:

According to ~~claim 12~~ a twelfth aspect of the present invention, an image processing apparatus for performing image decoding which comprises a reproducing section for reproducing a coded image signal in which a digital image signal has been coded by the use of a prediction image signal of the digital image signal and outputting a reproduced image signal, and a predicting section for producing the prediction image signal from the reproduced image signal, and the reproducing section comprise a data analyzing unit for analyzing the coded image signal to extract a compressed difference signal of the digital image signal and a sample identifier indicating correlation between pixel

10

values of the digital image signal from the coded image signal; ~~a~~ a data expanding ~~means~~ device for expanding the compressed difference signal to produce an expanded difference signal; and an adder for adding the expanded difference signal to the prediction signal to produce the reproduced image signal, and in the predicting section, using at least one of the reproduced image signal and the prediction image signal obtained from the reproduced image signal as a signal to be padded, padding is performed to the signal to be padded according to the sample identifier, by rearranging pixels in an image space formed by the signal to be padded and replacing values of insignificant pixels in the image space where the pixels have been rearranged with padding pixel values generated by a prescribed method.

Please amend the paragraph beginning on line 8 of page 23 as follows:

In the image processing apparatus thus constructed, the predicting section for producing the prediction image signal of the digital image signal comprises ~~a~~ a padding ~~means~~ device for performing padding of pixel values to the reproduced image signal or the prediction image signal of the digital image signal as the signal to be padded, and the padding process rearranges pixel values of the signal to be padded and then replaces values of insignificant pixels of the signal to be padded with prescribed padding pixel values. Therefore, when decoding a coded difference signal of the interlacing scanned image or the image of a stripe pattern having an arbitrary shape, it is possible to avoid introduction of high-frequency components into the prediction image signal for use by the differential decoding. As a result, differential decoding adapted to differential coding which suppresses degradation of coding efficiency resulting from padding of pixel values, is realized.

Please amend the paragraph beginning on line 25 of page 23 as follows:

According to ~~claim 13~~ a thirteenth aspect of the present invention, in the image processing apparatus of ~~claim 12~~ the twelfth aspect of the invention, the predicting section further comprises ~~a~~ a padding ~~means~~ device for performing padding to the reproduced image signal frame by frame or field by field according to the sample identifier, and a frame memory for storing a padded reproduced

11

signal in which the reproduced image signal has been padded, and outputs the padded reproduced image signal stored in the frame memory to the reproducing section as the prediction image signal.

Please amend the paragraph beginning on line 7 of page 24 as follows:

According to ~~claim 14~~ a fourteenth aspect of the present invention, in the image processing apparatus of ~~claim 12~~ the twelfth aspect of the invention, the predicting section further comprises a frame memory for storing the reproduced image signal, and a padding ~~means~~ device for performing padding to the prediction image signal extracted from the reproduced image signals stored in the frame memory frame by frame or field by field according to the sample identifier, and outputs the padded prediction image signal to the reproducing section.

Please amend the paragraph beginning on line 12 of page 25 as follows:

According to ~~claim 15~~ a fifteenth aspect of the present invention, an image processing apparatus for performing image decoding, which comprises a reproducing section for reproducing a coded image signal in which a digital image signal has been coded by the use of a prediction image signal of the digital image signal and outputting a reproduced image signal, and a predicting section for producing the prediction image signal from the reproduced image signal, the reproducing section comprises a data analyzing unit for analyzing the coded image signal to extract a compressed difference signal of the digital image signal and a sample identifier indicating correlation between pixel values of the digital image signal from the coded image signal; a data expanding ~~means~~ device for expanding the compressed difference signal to produce an expanded difference signal; and an adder for adding the expanded difference signal to the prediction image signal to produce the reproduced image signal, and the predicting section comprises a padding ~~means~~ device for performing padding to the reproduced image signal according to the sample identifier, by replacing values of insignificant pixels in an image space formed by the reproduced image signal with padding pixels values generated from values of significant pixels other than pixels adjacent to the insignificant pixels; and a

12

rearrangement ~~means~~ <u>device</u> for rearranging pixels in an image space formed by the padded reproduced image signal, according to the sample identifier.

Please amend the paragraph beginning on line 4 of page 27 as follows:

According to ~~claim 16~~ <u>a sixteenth aspect</u> of the present invention, a data recording medium for storing a program which makes a computer perform padding of pixel values to a digital image signal forming an original image space comprising an image having an arbitrary shape and comprising significant pixels and insignificant pixels, and the program makes the computer perform padding of the pixel values according to the digital image padding method of ~~claim 1~~ <u>the first aspect of the invention</u>.

Please amend the paragraph beginning on line 18 of page 27 as follows:

According to ~~claim 17~~ <u>a seventeenth aspect</u> of the present invention, a data recording medium for storing a program which makes a computer perform padding of pixel values to a digital image signal forming an original image space comprising an image having an arbitrary shape and comprising significant pixels and insignificant pixels, and the program makes the computer perform padding of pixel values according to the digital image padding method of ~~claim 7~~ <u>the seventh aspect of the invention</u>.

Please amend the paragraph beginning on line 6 of page 28 as follows:

According to ~~claim 18~~ <u>an eighteenth aspect</u> of the present invention, a data recording medium for storing a program which makes a computer perform padding of pixel values to a digital image signal forming an original image space comprising an image having an arbitrary shape and comprising significant pixels and insignificant pixels, and the program makes the computer perform padding of pixel values according to the digital image padding method of ~~claim 8~~ <u>the eighth aspect of the invention</u>.

Please amend the paragraph beginning on line 19 of page 28 as follows:

According to ~~claim 19~~ the nineteenth aspect of the present invention, a data recording medium for storing a program which makes a computer perform image signal coding, and the program makes the computer perform differential coding to a digital image signal by image processing apparatus of ~~claim 10~~ the tenth aspect of the invention.

Please amend the paragraph beginning on line 4 of page 29 as follows:

According to ~~claim 20~~ a twentieth aspect of the present invention, a data recording medium for storing a program which makes a computer perform image signal decoding, and the program makes the computer perform differential decoding to the digital image signal by the image processing apparatus of ~~claim 12~~ the twelfth aspect of the invention.

Please amend the paragraph beginning on line 14 of page 29 as follows:

According to ~~claim 21~~ a twenty-first aspect of the present invention, a data recording medium for storing a program which makes a computer perform image signal decoding, and the program makes the computer perform differential decoding to the digital image signal by the image processing apparatus of ~~claim 15~~ the fifteenth aspect of the invention.

Please amend the paragraph beginning on line 4 of page 32 as follows:

Figure 15 is a block diagram for explaining ~~a~~ an image decoding apparatus according to a modification 1 of the fourth embodiment.

Please amend the title beginning on line 21 of page 32 as follows:

~~Best Mode for Carrying Out the Invention~~ Description of the Preferred Embodiments

14

Please amend the paragraph beginning on line 12 of page 35 as follows:

~~Besides~~ Also, the original image space 301 may be a region of the object (object region) itself comprising the object, or may be one of plural image spaces (blocks) each comprising a prescribed number of pixels (for example N x M samples), into which region is divided. In this embodiment, for convenience, assume that digital image signals of object regions are sequentially input frame by frame in step S11.

Please amend the paragraph beginning on line 3 of page 38 as follows:

Comparing these small image spaces resulting from padding to the odd-numbered field image 381 and the even-numbered field image space 382 (see figure 20) obtained by the prior art method, sample values of pixels in the small image spaces 405 and 406 (see figure 3) are uniform, which shows that high-frequency components ~~is~~ are not introduced into the image signals of these small images.

Please amend the paragraph beginning on line 1 of page 41 as follows:

Subsequently, ~~modification~~ modifications 1-3 of the first embodiment will be described.

Please amend the paragraph beginning on line 8 of page 41 as follows:

In this digital image padding method of the modification 1 of the first embodiment, a process for merging pixels in step S16 is added to the steps S11-S15 in the digital padding method of the first embodiment in figure 1.

Please amend the paragraph beginning on line 15 of page 43 as follows:

In the padding method of the modification 2 of the first embodiment, in step S51, a digital image forming a prescribed original image space where pixels are arranged in a matrix is input. Subsequently in step S52, the degree of correlation of pixel values between adjacent pixel columns is computed for the original image space. More specifically, in this modification, differences of

15

sample values of pixels between each pair of adjacent odd-numbered and even-numbered pixel columns in the original images space are computed, and absolute values of the differences are added for each pair of odd-numbered and even-numbered pixel columns, to generate first evaluation values.

Please amend the paragraph beginning on line 22 of page 47 as follows:

In the padding method of the modification 3 of the first embodiment, in step S61, a digital image signal forming a prescribed original image space in which pixels are arranged in a matrix input. In this modification 3, suppose that the digital image signal corresponds to the interlaced image, and forms the image space 301 shown in figure 2.

Please amend the paragraph beginning on line 4 of page 49 as follows:

Figure 7 is a diagram for explaining field by field padding of the original image space 301 in figure 2. Figure 7 (a) shows a small image space 701 corresponding to the odd-numbered field in the original image space 301, and a small ~~imalge~~ image space 703 obtained by padding the small image space 701. Figure 7 (b) shows a small image space 702 corresponding to an even-numbered field in the original image space 301, and shows a small image space 704 obtained by padding the small image space 702.

Please amend the paragraph beginning on line 18 of page 50 as follows:

Specifically, the digital image padding of the second embodiment includes a first replacement step S21 (see figure 8(a)) for sequentially replacing sample values of insignificant pixels in the horizontal direction and a second replacement step S22 (see figure 8(b)) for replacing sample values of insignificant pixels in the vertical direction. In the second replacement step S22, sample values of insignificant pixels in an image space 801a obtained through the first replacement step ~~S22~~ S21, are replaced with sample values of pixels on a pixel row adjacent to a pixel row comprising the insignificant pixels, one pixel row spaced apart therefrom.

16

Please amend the paragraph beginning on line 22 of page 54 as follows:

The image coding apparatus 100a further includes a subtracter 102 for outputting difference between the blocked image signal Bg of the target block and the prediction signal Prg as a difference signal (prediction error signal) Dg, ~~a~~ a data compressing ~~means~~ device 110 for performing information compression to the output Dg of the subtracter 102 according to the sample identifier Di and outputting a compressed difference signal Qg, and a variable length encoder (VLC) 103 for performing variable length coding to the output Qg of the data compressing ~~means~~ device 110 and outputting a coded image signal Eg.

Please amend the paragraph beginning on line 8 of page 55 as follows:

The data compressing ~~means~~ device 110 includes a pixel rearrangement unit 113 for rearranging pixels of a difference image signal formed by the difference signal Dg according to the sample identifier Di, a DCT unit 111 for performing discrete cosine transform to an output PDg of the pixel rearrangement unit 113, and a quantizer 112 for quantizing an output Tg of the DCT unit 111 and outputting quantization coefficients as the compressed difference signal Qg. The discrete cosine transform is performed for each of 4 blocks each comprising 8 x 8 pixels into which the block comprising 16 x 16 pixels is divided. Where the rearrangement has been performed, a block 250c is divided into small blocks 251-254 as shown in figure 10 (c), whereas where the rearrangement has not been performed, a block 250b is divided into small blocks 255-258 as shown in figure 10 (b).

Please amend the paragraph beginning on line 7 of page 56 as follows:

The predicting section 120a includes a data expanding ~~means~~ device 130 for performing expansion to the output Qg of the data compressing ~~means~~ device 110 and outputting an expanded difference signal Itg, and an adder 123 for adding the expanded difference signal Itg to the prediction image signal Prg and outputting a restored image signal Lrg. The data expanding ~~means~~ device 130 includes an inverse quantizer 121 for inversely quantizing the output Qg of the data compressing ~~means~~ device 110, and an IDCT unit 122 for performing inverse DCT to an output IQg of the inverse

17

quantizer 121 by transforming data in a frequency domain into data in a spatial domain, and outputting the expanded difference signal Itg.

Please amend the paragraph beginning on line 19 of page 56 as follows:

The predicting section 120a further includes a padding ~~means~~ <u>device</u> 150 for performing padding to the restored image signal Lrg from the adder 123 according to the sample identifier Di, and a prediction signal producing ~~means~~ <u>device</u> 140 for producing the prediction image signal Prg from a padded restored image signal Pag.

Please amend the paragraph beginning on line 25 of page 56 as follows:

The prediction signal producing ~~means~~ <u>device</u> 140 includes a frame memory 124 for storing the output Pag of the padding ~~means~~ <u>device</u> 150, a motion detecting unit (ME) 125 for computing a motion vector MV of the target block based on the image data Mg stored in the frame memory 124, the blocked image signal Bg, and the sample identifier Di and outputting the MV, and a motion compensating unit (MC) 126 for generating an address Add1 of the frame memory 124 according to the motion detecting unit 125 and outputting an image signal in a memory area of the address Add1 as the prediction signal Prg. The motion detecting unit 125 is used for generating a motion vector of a frame and a motion vector of a field according to the sample identifier Di. The motion vector MV and the sample identifier Di are variable length coded by the variable length encoder 103 together with the compressed difference signal Qg.

Please amend the paragraph beginning on line 16 of page 57 as follows:

As shown in figure 9 (b), the padding ~~means~~ <u>device</u> 150 includes a frame padding unit 128a for padding the output Lrg of the adder 123 frame by frame, a field padding unit 128b for padding the restored image signal Lrg from the adder 123 field by field, a primary switch 127a provided at a primary stage of these padding units, for supplying one of the padding units with the restored image signal Lrg from the adder 123, a secondary switch 127b provided at a next stage of these padding

18

units, for selecting one of outputs Pa1 and Pa2 of respective padding units according to the sample identifier Di, and a pixel rearrangement unit 129 for receiving a padded restored signal as a selected signal Spa from the secondary switch 127b and rearranging pixels in an image space formed by the padded restored image signal.

Please amend the paragraph beginning on line 23 of page 58 as follows:

Next, a data structure of a coded image signal output from the image coding apparatus 100a will now be described. Figure 11 schematically shows a data structure of the coded image signal.

Please amend the paragraph beginning on line 2 of page 59 as follows:

In this bit stream 200, a bit string F corresponding to a frame image comprises a synchronous image signal 203 indicative of a starting point of a code string, a quantization step value 204 indicative of a quantization scale (quantization step) for use by quantization in coding process, and data D (1), D (2), D (3), . . ., D (i), corresponding to blocks (macroblocks) MB (1), MB (2), MB (3), . . ., MB (i) each comprising 16 x 16 pixels. Reference numerals 205, 208, and 211 designate sample identifiers each ~~indicates~~ indicating whether or not correlation between pixels in fields is higher than correlation between pixel values in a frame. Reference numerals 206, 209, and 212 designate variable length coded motion vectors. Reference numerals 207, 210, and 213 designate DCT coefficients of subblocks each comprising 8 x 8 pixels of each block. The data D (1), data D (2), and D (3) corresponding to respective macro blocks comprises, the sample identifier 205, the motion vector 206, and the DCT coefficient 207, the sample identifier 208, the motion vector 209, and the DCT coefficient 210, and the sample identifier 211, the motion vector 212, and the DCT coefficient 213, respectively. In figure 11, reference numeral 214 designates a synchronous image signal of a frame subsequent to the frame F.

Please amend the paragraph beginning on line 1 of page 61 as follows:

When the difference signal Dg is supplied to the data compressing ~~means~~ <u>device</u> 110, the pixel rearrangement unit 113 subjects the difference signal Dg to rearrangement according to the sample identifier Di. Specifically, where the digital image signal corresponds to the interlaced image, the difference signal Dg is subjected to rearrangement and input to the DCT unit 111, whereas where the digital image signal corresponds to the progressive image, the difference signal Dg is directly input to the DCT unit 111 without rearrangement. The DCT unit 111 performs DCT to the output PDg of the pixel rearrangement unit 113. More specifically, for the block corresponding to the interlaced image, the block is divided into subblock as shown in figure 10 (c), and for the block corresponding to the progressive image, the block is divided into subblocks as shown in figure 10 (b), and then the output PDg is subjected to DCT for each subblock. The quantizer 112 quantizes an output Tg of the DCT unit 111 by a quantization step and outputs quantization coefficients Qg of the difference signal to the variable length encoder 103 and the information expanding section 130.

Please amend the paragraph beginning on line 8 of page 62 as follows:

In the padding ~~means~~ <u>device</u> 150, the restored image signal Lrg is supplied to one of the frame padding unit 128a and the field padding unit 128b through the switch 127a. At this time, switching of the switch 127a is controlled according to the sample identifier Di. Where a value of the sample identifier Di is 1, that is, there is high correlation between pixels in the fields, the restored image signal Lrg is supplied to the field padding unit 128b through the switch 127a and is subjected to intra-field padding therein. Specifically, as shown in figure 10(c), padding is performed to the restored image signals of small blocks 251 and 252 composed of lines of the first field of the restored image space 250c at a time, and the restored image signals of small blocks 253 and 254 composed of lines of the second field of the restored image space 250c at a time.

20

Please amend the paragraph beginning on line 9 of page 65 as follows:

In an image coding apparatus 100b of the modification 1 of the third embodiment, only a predicting section 120b differs from that of the image coding apparatus 100a of the third embodiment, and in the predicting section 120b of the image coding apparatus 100b, the padding ~~means~~ <u>device</u> 150 of the predicting section 120a of the first embodiment is replaced with a merging unit 151 which performs merging wherein pixels in an image space formed by the restored image signal Lrg from the adder 123 are rearranged, and <u>a</u> padding ~~means~~ <u>device</u> 150b which performs padding to an output of the merging unit 151.

Please amend the paragraph beginning on line 19 of page 65 as follows:

The merging unit 151 is, as shown in figure 10 (d), used for rearranging pixels by alternately arranging pixels rows in the upper region 250d1 and pixel rows in the lower region 250d2 of the image space 250d. The padding ~~means~~ <u>device</u> 150b includes the primary and secondary switches 127a and 127b, the frame padding unit 128a, and the field padding unit 128b of the padding ~~means~~ <u>device</u> 150 of the third embodiment, the field padding unit 128b performing padding by the digital image padding method of the second embodiment. The other components are identical to those of the third embodiment.

Please amend the paragraph beginning on line 8 of page 68 as follows:

Figure 13 is a diagram showing an image coding apparatus according to a modification of the third embodiment of the present invention, wherein figure 13(a) shows an entire construction of the image coding apparatus and figure 13(b) shows <u>a</u> padding ~~means~~ <u>device</u> 150c of the data compressing ~~means~~ <u>device</u> 110c of the image coding apparatus.

Please amend the paragraph beginning on line 14 of page 66 as follows:

In an image coding apparatus 100c of the modification 2 of the third embodiment, only <u>a</u> data compressing ~~means~~ <u>device</u> 100c differs from that of the image coding apparatus 100a of the third

21

embodiment, and the data compressing ~~means~~ <u>device</u> 110c of the image coding apparatus 10c is provided with <u>a</u> padding ~~means~~ <u>device</u> 150c which performs padding to an output PDg of the pixel rearrangement unit 113 between the pixel rearrangement unit 113 and the DCT unit 111 at the next stage of the data compressing ~~means~~ <u>device</u> 110 of the third embodiment.

Please amend the paragraph beginning on line 23 of page 66 as follows:

The padding ~~means~~ <u>device</u> 150c includes a frame padding unit 158a for performing padding to the output PDg of the rearrangement unit 113 frame by frame, a field padding unit 158b for performing padding to the output PDg of the rearrangement unit 113 field by field, a primary switch 157a provided at a previous stage of these padding units, for supplying one of these padding units with the output PDg according to the sample identifier Di, and a secondary switch 157b provided at a next stage of these padding units, for selecting one of outputs PDg 1 and PDg 2 of the padding units according to the sample identifier Di.   Constructions of the frame padding unit 158a and the field padding unit 158b are identical to those of the frame padding unit 128a and the field padding unit 128b of the third embodiment.

Please amend the paragraph beginning on line 25 of page 67 as follows:

Specifically, the image decoding apparatus 900a includes a data analyzing unit 902 for receiving a coded difference signal Eg of a target block to be decoded (target block), and performing analysis and variable length decoding to the coded difference signal Eg, <u>a</u> data expanding ~~means~~ <u>device</u> 903 for expanding an output AEg of the data analyzing unit 902 and outputting an expanded image signal DEg, an adder 906 for adding te output DEg to a prediction image signal Pg2 of the target block, an inverse blocking unit 907 for integrating reproduced image signals of respective blocks as an output of PEg of the adder 906 and outputting an image output signal REg of a scanning line structure, and a predicting section 910a for producing the prediction image signal Pg2.

Please amend the paragraph beginning on line 14 of page 68 as follows:

The data expanding ~~means~~ <u>device</u> 903 comprises an inverse quantizer 904 for inversely quantizing the output AEg of the data analyzing unit 902, and an IDCT unit 905 for performing IDCT (inverse discrete cosine transform) as one type of inverse frequency transform, to the output DEg1 of the inverse quantizer 904, and outputting the expanded difference image signal DEg.

Please amend the paragraph beginning on line 21 of page 68 as follows:

The predicting section 910a includes <u>a</u> padding ~~means~~ <u>device</u> 920a for performing padding to the output PEg of the adder 906, a frame memory 909 which contains an output Pa of the padding ~~means~~ <u>device</u> 920a as a reproduced image signal, and a motion compensating unit 911 for generating an address Add2 of the frame memory 909 according to an output Rg2 of the frame memory 909 and a motion vector MV of the block which has been decoded by the data analyzing unit 902, and reading a prediction image signal Pg2 of the target block from the frame memory 909 which contains recorded data Rg2 using the address Add2.

Please amend the paragraph beginning on line 6 of page 69 as follows:

The padding ~~means~~ <u>device</u> 920a includes a frame padding unit 921a for performing padding to the output PEg of the adder 906 frame by frame, a field padding unit 921b for performing padding to the output PEg field by field, a primary switch 922 provided at a previous stage of these padding units, for supplying one of them with the output PEg according to the sample identifier Di from the data analyzing unit 902, a secondary switch 923 provided at a next stage thereof, for selecting one of outputs Pa1 and Pa2 of respective padding units according to the sample identifier, and a pixel rearrangement unit 924 for rearranging pixels of the padded image signal as a selected signal Pas from the secondary switch 923.

23

Please amend the paragraph beginning on line 23 of page 69 as follows:

When the compressively coded image signal Eg, for example, the bit stream 200 in figure 11 is input to the input terminal 901a, the data analyzing unit 902 performs variable length decoding to the coded image signal by analysis. The resulting decoded data is output to the data expanding ~~means~~ device 903 as a compressed difference signal AEg in which a quantization step or a DCT coefficient has been compressed. The data analyzing unit 902 also outputs the motion vector MV and the sample identifier Di to the predicting section 910a.

Please amend the paragraph beginning on line 8 of page 70 as follows:

The data expanding ~~means~~ device 903 expands the compressed difference signal to be restored to an expanded difference signal of the target block. Specifically, the inverse quantizer 904 inversely quantizes the compressed difference signal, and then the IDCT unit 905 performs inverse frequency transform to the output DEg1 of the quantizer 904, by transforming a signal in a frequency domain into a signal in a spatial domain.

Please amend the paragraph beginning on line 16 of page 70 as follows:

The motion compensating unit 911 generates the address Add2 for accessing the frame memory 909 according to motion vector MV from the data analyzing unit 902 and extracts the prediction image signal Pg2 of the target block from the reproduced image signal stored in the frame memory 909. The adder 906 adds the output DEg of the data expanding ~~means~~ device to the prediction image signal Pg2 and outputs the reproduced image signal PEg of the target block.

Please amend the paragraph beginning on line 7 of page 75 as follows:

In the predicting section 910b, there is provided a padding ~~means~~ device 920b between a motion compensating unit 911 and an adder 906, for performing padding to a motion compensated prediction image signal Pg2 and supplying the resulting signal to the adder 906. The padding ~~means~~ device 920b includes a frame padding unit 921a, a field padding unit 921b, a primary switch 922 for

24

supplying one of these padding units with the prediction image signal Pg2 from the motion compensating unit 911 according to the sample identifier Di, and a secondary switch 923 for selecting one of outputs of the padding units according to the sample identifier Di and outputting a selected signal to the adder 906.

Please amend the paragraph beginning on line 19 of page 76 as follows:

Figure 16 is a block diagram showing an image decoding apparatus according to modification 2 of the fourth embodiment. An image decoding apparatus 900c according to the modification 2 of the fourth embodiment has constructions of the image decoding apparatus 900a of the fourth embodiment and the image decoding apparatus 900b of its modification 1 in combination. In other words, in addition to the predicting section 910a comprising the padding ~~means~~ device 920a of the image decoding apparatus 900a of the fourth embodiment, the image decoding apparatus 900c includes an auxiliary padding ~~means~~ device (second padding ~~means~~ device) 920c2 provided at a next stage of the motion compensating unit 911, the output of which is output to the adder 906. Here it is assumed that constructions of the first and second padding ~~means~~ devices 920c1 and 920c2 are identical to those of the padding ~~means~~ device 920a of the fourth embodiment and the padding ~~means~~ device 920b of the modification 1 of the fourth embodiment, respectively.

Please amend the paragraph beginning on line 11 of page 77 as follows:

In the modification 2 of the fourth embodiment thus constructed, the first and second padding ~~means~~ devices 920c1 and 920c can share padding, whereby padding can be preformed in the predicting section with higher efficiency.

Please amend the title beginning on line 2 of page 79 as follows:

Industrial ~~Availability~~ Applicability

25